

NASA Acquisition Pollution Prevention Program Office
Kennedy Space Center, FL 32899

**NASA Support for the
Portuguese Institute of Environment/
Center for Pollution Prevention Program and Projects**

**Draft Final Report
June 16, 2004**

**NASA Contract: NAS10-03029
Task Order No. 2**



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Draft Final Report

C3P Program Overview

ITB supports the NASA Acquisition Pollution Prevention (AP2) Program Office in its business operations, including internationally. In 2002, NASA and the Portuguese Institute of Environment signed a Joint Statement and Terms of Reference to allow for international cooperation in qualifying new materials and processes to help solve commonly held manufacturing and maintenance environmental problems. This report covers ITB's performance under Task Order No. 2 for the period July 17, 2003 to July 16, 2004.

Review – C3P Core Program Support

Under Task Order No. 2, ITB performed technical, business, and program management, coordination and analysis, as well as administrative support to operate, staff, and provide for the services of the C3P office. C3P activities in the past year can be generally categorized as follows:

1. C3P program development
2. Stakeholder identification and commitment
3. Needs identification
4. Project development

Achievements and highlights under each of the four categories are discussed below.

1. Program Development

Under Task Order #2, C3P staff worked to develop and implement a Provisional Work Plan for C3P. Activities included developing a core infrastructure to support C3P program and project activities, mobilizing resources, developing and monitoring projects, and conducting the activities that were planned.

In March 2004, a C3P General Assembly was held. Representative C3P members, including NASA, attended. A report on 2003 activities, a Provisional Work Plan, and a 2004 Budget were analyzed and approved at the meeting. The meeting culminated with an audience with the Minister of Environment, who was enlightened on the NASA Workshop taking place next September.

In May 2004, Ms. Joana Vide was hired to support the C3P Program. Ms. Vide will interface with C3P program and European industrial representatives, scientists, engineers, and numerous subject matter experts in the day-to-day development of the C3P program and project requirements and activities.

Under TO#2, C3P also maintained the C3P Web site and added a Portuguese version to it.

2. Stakeholder Identification and Commitment

In accordance with decisions and recommendations set forth by the C3P Joint Oversight Group (JOG) in its meeting of September 2003, achievements in C3P stakeholder identification included the following:

- C3P/ISQ participated in the Environment and Quality Committees and Working Groups of AECMA and the new European Aerospace and Defense Industries Association, ASD on December, 10, 2003, March 15 and May 4, 2004. The ASD resulted from a recent merger of AECMA, Eurospace/ESA and EDIG in January 2004.
- C3P and its Members participated in some of the most relevant industrial meetings in

Portugal.

- C3P meetings in February and March 19, 2004 with representatives of AIND, the Portuguese Association of Printers, Publishers, and Periodicals; with FAEP, the European Federation of Magazine Publishers; and ENPA, the European Association of Newspapers, concerning a possible C3P project in the area of VOC reduction in the printing-publishing industry.
- C3P meetings with FAP, Portuguese Air Force Logistics Command in March, May and June on Development of FAP Environment/Quality Projects integration on C3P.
- C3P meetings with several Aerospace and Defense companies in Poland (the Eastern European most advanced country in these fields), under the umbrella of NIAG, the NATO Industry Advisory Group, on May, 24-31. Future positive development is expected, depending on appropriate contacts with Polish BUMAR Capital Group and ARP, Industrial Development Agency, beyond United Technologies-Pratt & Whitney, Bae Systems, Goodrich and Snecma Poland. *Attached is a **Trip Report**.*

Following are C3P stakeholder identification activities for which advance planning and discussions has occurred:

- C3P meetings with UK BAe Systems and TWI, looking at progress and implementation of a European Lead Free Solder Project. Meeting tentatively scheduled for July 2004.
- C3P presence at the Farnborough Air Show in July 2004, for dissemination of C3P information and contacts with major international companies.
- C3P meetings with EMBRAER/Brasil and South America, for which NASA's joint intervention becomes fundamental. EMBRAER technical representatives have indicated their intent to attend NASA's pollution prevention workshop in September.
- C3P meetings with INASMET (Inasmet is a private, non-profit making technology center in Barcelona, Spain, founded in 1962, with the purpose of serving the industrial community through technology transfer). ISQ will lead the process, jointly with C3P.
- C3P meetings with Swedish companies (e.g., GECL) already partnered with Bae Systems (UK).

3. Identify International Needs

In 2003, ITB identified and evaluated P2 needs relative to current NASA concerns. Utilizing the NASA AP2 methodology, ITB engineers conducted over 36 individual Pollution Prevention Opportunity Needs Assessment exercises in Portugal and identified the following 15 distinct P2 needs for C3P to consider:

1. Dem/Val of suitable alternatives to hexavalent chrome (Cr^{+6}) in metal surface finishing conversion coatings and primer coatings
2. Dem/Val of non-chrome sealants for the fuselage and other metal to metal panel joints
3. Identification, demonstration and validation (Dem/Val) of low/no-VOC paints and coatings
4. TCE replacement in dip tank cleaning and degreasing operations
5. Dem/Val of alternatives heavy metal plating (chrome and cadmium) for aerospace components
6. Lead-free solder reliability testing
7. Reduction/elimination of VOCs and HazMats in cleaning applications
8. Reduction/elimination of emissions from hexavalent chrome (Cr^{+6}) plating baths
9. VOC emission control
10. Dem/Val of PD680 replacement
11. Identification of non-hazardous paint stripping for aircraft aluminum shells
12. Dem/Val of lead-free dry film lubricants
13. Turco 4215 replacement
14. Non-trichloroethylene (TCE) oxygen line cleaning systems
15. VOC solvent and HazMat free technologies for depainting on aluminum and composite substrates

It should be noted that many of these projects follow the European Commission's new focus on reducing the use and release into the environment of hazardous chemicals like chromium, hydrochlorofluorocarbons (HCFCs) in solvents, and lead and other heavy metals and flame retardants in waste electrical and electronic equipment (WEEE). Such moves are exclusively and fully supported by EU Framework Programs V and VI. Previously, the Commission was more oriented toward gas emissions and noise.

4. **Project Development**

Working with OGMA and TAP, C3P and ITB took the previous list of 15 P2 needs and identified six (6) candidate EU/Portuguese P2 projects (Table 1), of these; ITB engineers recommended four projects for kickoff by C3P in 2004, and two in 2005. Projects identified were selected based on their importance to the stakeholders and the relative maturity of the alternative technologies or materials. Due to resource requirements, projects will be staggered through 2004 and 2005.

Table 1 – 2004 Candidate EU/Portuguese P2 Projects

No.	Project ID	Description
1	C3P.Proj.CCC.Port.001	Identification of suitable alternatives to hexavalent chrome (Cr+6) in conversion coating Alodine 1200 on AL 2024, 7075, and 6061.
2	C3P.Proj.NCS.Port.001	Dem/Val of Non-Chrome sealants for the fuselage and other metal to metal panel joints
3	C3P.Proj.VOC.Port.001	Replacement of high VOC coatings for aircraft painting and in general painting scheme.
4	C3P.Proj.TCE.Port.001	Trichloroethylene (TCE) replacement in dip tank cleaning and degreasing operations. It is regulatory requirement that TCE use cease in 2007.
5	C3P.Proj.CPC.Port.001	Dem/Val of suitable alternatives to hexavalent chrome (Cr+6) in primer coatings (AL 2024, 7075, 6061).
6	C3P.Proj.CEC.Port.001	Dem/Val of alternatives to Chrome and Cadmium plating on fasteners and engine components; landing gear, turbine fans, etc.

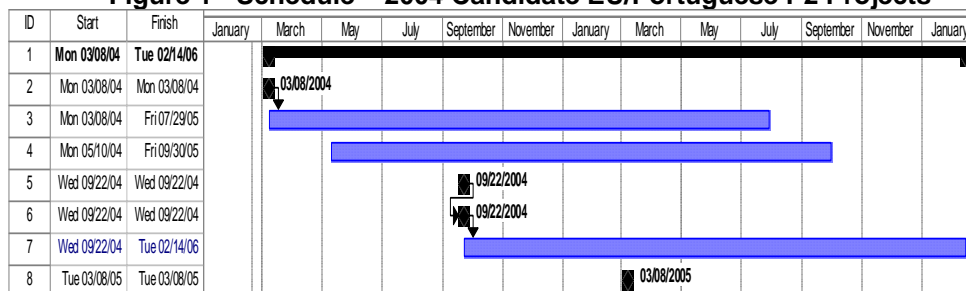
During the project identification and selection phase the following considerations were taken into account;

- Importance to the Portuguese stakeholders
- The maturity of the alternative technologies
- Level of reciprocating benefit to NASA

Schedule

ITB maintains each project's schedule in Microsoft Project (Figure 1).

Figure 1 - Schedule – 2004 Candidate EU/Portuguese P2 Projects



The following sections provide further discussion on ITB's activities in international project development.

a. Tap-OGMA Projects

1. Identification of Suitable Alternatives to Hexavalent Chrome (Cr+6) in Conversion Coating Alodine 1200 on AL 2024, 7075, and 6061

Objective

Test and implement alternatives to conversion coating Alodine 1200 in aircraft processing operations at TAP-Air Portugal and the Oficinas Gerais de Material Aeronáutico (OGMA).

Achievements

- P2 needs assessments conducted at OGMA and TAP resulted in the identification FY04 C3P projects
- Follow-on technical meetings at OGMA / TAP helped solidify commitment and define project parameters
- C3P OGMA and TAP have agreed to move forward with this project—C3P's first joint project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004
- C3P began preparation of technical documents - JTP, PAR, and CBA.

Next Steps

- Complete the technical documents.
- Begin laboratory and field testing.

2. Demonstration and Validation of Non-Chrome Sealants

Objective

Test and implement alternatives to hexavalent chrome containing sealants used in aerospace industry to seal critical metal to metal joints and impart corrosion inhibiting properties. Hexavalent chrome containing sealants are used in the aerospace industry to seal critical metal-to-metal joints.

Achievements

- Conducted technical meetings at OGMA / TAP to establish project parameters and define commitment
- OGMA and TAP have agreed to move forward with this project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004

Next Steps

- Prepare the following draft documents - JTP, PAR, CBA and Field Test demonstration / validation studies.
- Begin laboratory and field testing.

3. Replacement of High-VOC Coatings

Objective

Test and implement alternatives to currently used high VOC coatings by the Portuguese industry. This project has reciprocal benefit to NASA because we are currently working with the Joint Services to reduce VOC emission levels in domestic operations.

Achievements

- Conducted technical meetings at OGMA / TAP to establish project parameters and define commitment
- OGMA and TAP have agreed to move forward with this project.
- Defined project teams and conducted a formal project kick-off meeting in March 2004

Next Steps

- Prepare the following draft documents - JTP, PAR, CBA and any Field Test demonstration / validation studies.
- Begin laboratory and field testing.

4. Dem/Val of Alternatives to Chrome and Cadmium Plating on Fasteners and Engine Components; Landing Gear, Turbine Fans

Objective

Test and implement alternatives to chrome and cadmium plating on fasteners and engine components; landing gear, turbine fans, etc.

Achievements

- P2 needs assessments conducted at OGMA and TAP resulted in the identification FY04 C3P projects

Next Steps

- Technical meetings (tentatively July 2004) at OGMA / TAP to help solidify commitment and define project parameters

b. Financial Instrument for the Environment (LIFE) Projects

1. Portuguese National VOC Reduction Project

Objective

Identify, test, and validate low-VOC materials for commercial and industrial process in Portugal. This project is in support of EU Directive 1999/13/CE - to reduce both the direct and indirect effects of VOC emissions to human health. The Directive was adopted in Portugal by law DL n° 242/2001 which imposes;

- a) Elaboration of plans for solvent management concerning involved industrial sectors
- b) Elaboration of plans for solvent management for each industrial unit
- c) Observation of compliance to emission limit values

Achievements

- ITB engineers performed VOC P2 site assessments at 30+ facilities in Portugal. ITB engineers identified the following pollution prevention opportunities for a national VOC programme:
 - VOC emission control – control release until low VOC materials/processes are qualified
 - Reduction/elimination of VOCs and hazardous materials in cleaning applications
 - Identification, demonstration and validation of low/no-VOC paints, coatings, inks and adhesives
 - Reduction/elimination of VOCs from ink/paint stenciling and marking
- C3P submitted VOC reduction proposal to European programme LIFE 2003/2004.

Next Steps

- C3P/NASA will continue to build stakeholder base as project is developing.
- Upon receipt of LIFE authorization C3P shall define and scope national VOC projects.
- Initiate LIFE VOC Project.

c. Sixth Framework (Fr6) Programme Projects

1. Lead-Free Solder Reliability (“MILEAD”) Project

Objective

Design “green electronics” testing program that will complement JG-PP and other European lead-free testing programs. This project will address the impact of the following parameters on reliability:

- Solder alloy
- Board finish
- Components
- Tests and testing conditions

Achievements

- ITB performed solder site assessments at 12+ facilities in Portugal revealed interest and need for reliability data on new lead-free solders.
- C3P identified ISQ and INEGI as leads for the project
- C3P prepared and submitted an official Portuguese national proposal in April 2004.

Next Steps

- C3P/NASA will continue to build stakeholder base as project is developing. For example, C3P and ITB plan to meet with MILEAD stakeholders in Portugal in July 2004
- A complementary submittal will eventually be made to an FP6 Program (tbd). Evaluation results will hopefully be known by the end of the year.
- Upon receipt of Fr6 authorization C3P shall define and scope project.
- Initiate lead-free solder project

2. HISCA Project

Objective

Submit project proposal - Heavy Ions Substitution for SME Supply Chain in Aeronautics, “HISCA” to Fr6. This project address a reduction in the use of heavy ions in European aerospace processing.

Achievements

C3P submitted the proposal as a joint effort by:

- AIRBUS
- The European Association of Aerospace Industries (AECMA)
- The German Aerospace Industries Association (BDLI)
- C3P
- The French Aerospace Industries Association (GIFAS)
- Hellenic Aerospace Industry (HAI)
- ROLLS ROYCE
- The Society of British Aerospace Companies (SBAC).

Status

C3P’s HISCA proposal received a relatively weak evaluation by the EU Framework Program VI. (The HISCA was a Priority 3 Project in terms of funding.) The likely reason for the low score is because the orientation of the European Commission General Directorates, Enterprise and Environment (at the time [spring 2003]) toward control of noise and gas emissions in aerospace. This focus has now changed, but the proposal was already evaluated.

Next Steps

- C3P will continue to build stakeholder base as project is developing.
- Upon receipt of Fr6 authorization C3P shall define and scope project.
- Eventually, initiate HISCA project.